HERINGIA SENILIS SACK (DIPTERA: SYRPHIDAE): A HOVERFLY NEW TO BRITAIN

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Abstract. *Heringia senilis* Sack, a hoverfly new to the British list, is reported. Adults were reared from larvae found inhabiting the spiral leaf-petiole galls on Lombardy poplar trees, formed by colonies of the aphid *Pemphigus spyrothecae* (=*spirothecae*) Passerini, in Forster Memorial Park, Catford, south-east London. Its problematic distinction from *H. heringi* (Zett.) is discussed.

INTRODUCTION

On 30.ix.1999 I was examining the characteristic spiral galls, caused by the communal aphid *Pemphigus spyrothecae* (=*spirothecae*) Passerini, on the leaf petioles of Lombardy poplars in Forster Memorial Park, Catford, south-east London, TQ3872. My thoughts were for the predatory bug *Anthocoris minki* Dohrn, known to occupy these galls. The bug was indeed present, much to my surprise (Jones, 2000), and as I searched about 100 galls, I also uncovered a number of small brown hoverfly larvae. Thinking it might be an interesting rearing record, I collected a dozen or so, together with the half unravelled but still aphid-occupied galls, into a selection of medium-sized glass tubes. The larvae remained in the tubes, half forgotten throughout the winter, and when patches of mildew and mould developed on the shrivelling galls I sadly anticipated that I had lost the subjects of my study to an age-old problem.

However, on 10.v.2000 I examined the tubes to discover a small black hoverfly had emerged. It was a dead female and rather shrivelled, but over the next few days several more specimens, males and females, appeared. They seemed to be what some European entomologists have called *Heringia senilis* Sack.

IDENTIFICATION

As per all other British lists, Stubbs & Falk (1983) include only *Heringia* (*sensu stricto*) *heringi* (Zett.) as British, but they allude to another species included by van der Goot (1981) in his Dutch hoverfly book, quoting hind tibial hair colour as a tantalizing distinction. His work is a Dutch translation of a key to the species of European Russia by Stackelberg (1970), modified to include additional species known to occur in the Low Countries, Britain, Ireland, Denmark and Northern Germany. He uses the hair colour of the male hind tibia as a primary distinctive characteristic, but also figures the male genitalia, suggesting the possibility of some further distinguishing features.

Verlinden (1991) also includes *H. senilis* in his Belgian hoverfly fauna, and again uses hind tibial hair colour in the male as a major distinguishing character. He also quotes various other characters, and makes further use of male genital shape to characterize the species.

When examining the flies that had emerged from my *Pemphigus* galls, the papers by van der Goot (1981) and Verlinden (1991) were not able to wholly convince me that my specimens were truly *H. senilis*. This was mainly because I could not easily

appreciate some of the suggested genitalia characters, and there appeared to be contradictions between some of these distinctions and the non-genitalia identifiers.

The important paper by Claussen *et al.* (1994) finally gave some clarity to my muddle. As well as using antennal shape and hind tibial hair colour, the shape of the post-anal lamella, a small shield-shaped plate visible between the surstyli, proved to be a convincing character and the interpretation they put forward for the two taxa agreed with my specimens, together with specimens of *H. heringi* in the Natural History Museum collection.

In their revision of the genus, Claussen *et al.* (1994) confirm that *H. heringi* is a valid species, but they are cautious of the true status of *H. senilis*. Despite maintaining it as a separate species, and nominating a lectotype for it, they note that no constant characters could be found to differentiate *H. senilis* from *H. heringi*. Their frustration revolved around variation between different European populations; so far, the British specimens that I have examined do conform fairly well to two separate species. Therefore, with an echo of their caution, I offer *Heringia senilis* here as a new British species.

Key to the British species of *Heringia* (*sensu stricto*)

The genus *Heringia* now includes those species formerly in the genus *Neocnemodon*, which is reduced to subgeneric status by Gilbert & Rotheray (1989). The subgenus *Heringia sensu stricto* is distinguished, as in the keys of Stubbs & Falk (1983), by the males having no spine on the hind trochanter. *Heringia senilis* is almost identical to *H. heringi*, to which it will work in the key by Stubbs & Falk (1983). Distinction between the two species is as follows:

1. Male (eyes meet on top of head) 2

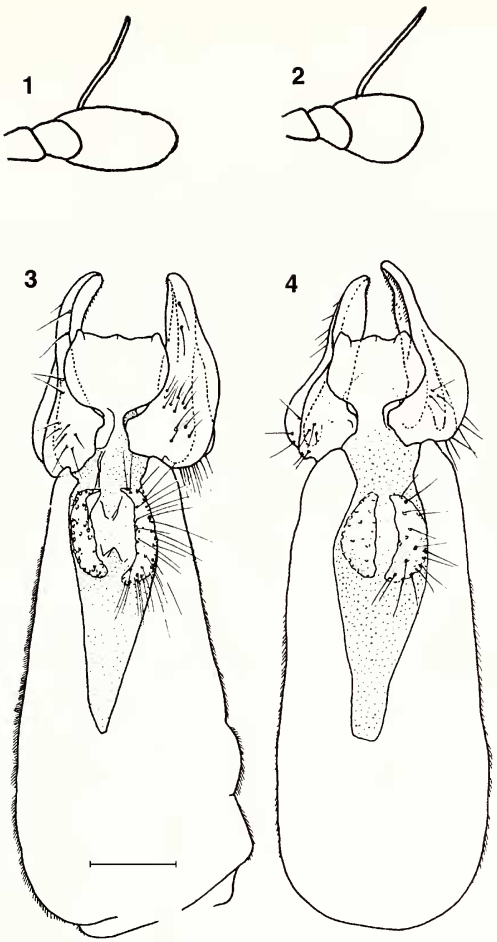
– Female (eyes separated). Confident identification not possible .....
H. senilis Sack and *H. heringi* (Zett.)

2. Third antennal segment longer (Fig. 1), about twice as long as wide. Outer edge of hind tibia clothed with long white hairs. Dorsum of pronotum covered with white hairs. Post-anal lamella, the small shield-shaped plate visible between the surstyli, relatively straight across its apical edge, with only very small teeth at corners (Fig. 3) ..... *H. senilis* Sack
– Third antennal segment shorter (Fig. 2), about 1.5 times as long as wide. Outer edge of hind tibia clothed with long black hairs. Dorsum of pronotum covered with dark hairs. Post-anal lamella indented along its apical edge, with definite teeth at corners and sometimes also at centre (Figs 4–6)..... *H. heringi* (Zett.)

Discussion on specific status and variation in characters

Most previous authors have concluded, reluctantly, that the status of *H. senilis* remains uncertain. Despite trying to find clear characters to distinguish it from *H. heringi*, there always seems to be intermediate variation between the two species such that no constantly reliable characters have been found.

The key by van der Goot (1981) is a Dutch translation, with additions, from a previous work by Stackelberg (1970) on Russian flies. In it, van der Goot relies most on male hind leg hair colour, but also illustrates the male genitalia. He suggests that the surstyli of *H. senilis* are shorter and thicker with different sculpture, but I found the diagrams difficult to interpret when examining my specimens. He also lists pale



Figures 1 & 2. Male antenna of *H. senilis* (1) and *H. heringi* (2). (Note: females have third antennal segment longer than males, the antenna of female *H. heringi* resembling that of male *H. senilis*.)
Figures 3 & 4. Dorsal view of male genitalia of *H. senilis* (3) and *H. heringi* (4), southern Germany. Note, in particular, the relative shapes of the shield-shaped plate between the surstyli, the post-anal lamella, which is evenly truncate with only minute side denticles in *H. senilis*, but distinctly indented with obvious side teeth in *H. heringi*. Scale bar = 0.2 mm. Reproduced, with permission, from Claussen *et al.* (1994).

hairs on the male face, femora, thoracic pleura and dorsum, and abdominal segments as indicating *H. senilis*, together with the longer oval shape of the female mouth opening, and white hairs at the base of the female costa. Incidentally, van der Goot (1981) also states in his key that females of *H. senilis* lack dust spots on the frons, reiterating part of Stackelberg's (1970) key. However, in a separate note, he comments that Sack's original description makes no mention of missing frontal dust

spots, and he also reports the finding of a female corresponding to this species, yet having the dust spots as usual. All the females that emerged in conjunction with my males of *H. senilis*, show clear dust spots on the frons.

Verlinden (1991) again uses hind tibial hair colour as his primary distinguishing character. He also repeats the comparison between the surstyli: their relative lengths and sculpture, but again, I found the figures very difficult to interpret when examining the specimens. Verlinden is the first to describe the plate between the surstyli. He reports it as being practically straight but roughly dentate along its top edge in *H. heringi*, and with three large teeth in *H. senilis*. However, this interpretation is directly contradicted by the later work of Claussen *et al.* (1994). It is also contradicted by the much earlier work of Verrall (1901), whose diagram of the genitalia of *Heringia* (then *Pipizella*) *heringi* clearly shows this plate to be strongly three-toothed (Fig. 7). Verlinden also repeats the list of characters, including pale hairs on the male face and abdominal segment 8 as indicating *H. senilis*, together with the shape of the female mouth opening, and white hairs at the base of the costa.

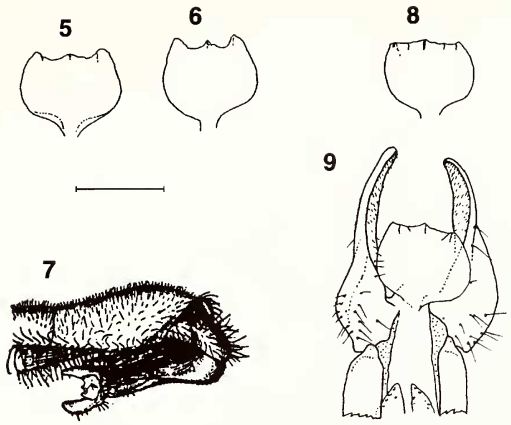
As stated above, however, it is the review by Claussen *et al.* (1994) which resolves some of the difficulties; their interpretation of the *H. senilis*/*H. heringi* species pair agrees most closely with the UK specimens of both species that I have seen. There remain some difficulties however.

The relative widths and lengths of the surstyli are again quoted by Claussen *et al.*: those in *H. senilis* reported as being 3.1 times as long as wide, those in *H. heringi* being 3.2–3.6 times as long as wide. The marginal sculpture of the right surstylus is reported as being stronger in *H. senilis*. Despite their inclusion of several diagrams of the surstyli, I found it difficult to interpret these characters, not least because the size and shape of *H. heringi* surstyli vary and 5 different surstyli figures are given for this species. Another equally variable character reported is a steely blue shimmer on the face and frons of *H. senilis* compared to black in *H. heringi*, but doubt is thrown on this because the colouring seemed to disappear with age.

It was the clear description and figures of the post-anal lamella that convinced me that I agreed with the analysis by Claussen *et al.* (1994), despite seeing limited UK material of *H. heringi*. In *H. senilis* this plate is always shield-shaped, with only the smallest of tooth-like prominences on the top corners (as in Fig. 3). In *H. heringi*, however, the corners were distinctly pronounced (as in Figs 4–6) and in one example clearly tridentate (as in Fig. 7). Despite this apparent conformity of characters, Claussen *et al.* report that, in *H. heringi*, the post-anal lamella appears to vary between populations from different parts of Europe. In two reputed specimens of *H. heringi* from Crete this plate exactly resembled *H. senilis* (Figs 8 & 9), and one of the examples was also clearly white-haired. They, however, conclude that the two specimens are *H. heringi* because of the thickly black-haired hind tibiae.

A summary of the characters used in distinguishing *H. senilis* and *H. heringi* is given in the table.

The material available to me has been limited. Of the 11 specimens reared from Forster Memorial Park, only 5 were males; however they all agreed with the interpretation of *H. senilis* put forward by Claussen *et al.* (1994)—with the exception of one which had a few black hairs amidst the white on the hind tibiae. Comparison with Turkish and Greek (Corfu) specimens of *H. senilis* in the European collection of the Natural History Museum confirmed their general similarity. However, there were only a handful of specimens in that collection and they had been identified using hair colour and antennal length; none of the males had the genitalia pulled out for examination.



Figures 5 & 6. *Heringia heringi*, post-anal lamella, specimens from northern Germany (5) and Romania (6). Reproduced, with permission, from Claussen *et al.* (1994)
Figure 7. Male genitalia of *H. heringi*. Note the distinctly three-toothed plate between the surstyli, the post-anal lamella, at the extreme apex of the genitalia. Reproduced from Verrall (1901).
Figures 8 & 9. Post-anal lamella of *H. heringi*, specimens from Crete, closely resembling *H. senilis* in that they show hardly any sign of being toothed at the corners. Reproduced, with permission, from Claussen *et al.* (1994).

Of the very many specimens of *H. heringi* in the British collection of the Natural History Museum, several appeared to be pale-haired, but they may have been teneral or faded. Certainly the antennae of these specimens were generally shorter than in my *H. senilis*. Only three specimens had the male genitalia extracted for examination, but luckily, they all showed the large corner teeth on the post-anal lamellae.

Since then some more material has come to light. Of three specimens reared from *Pemphigus* galls in Cambridge, and sent to me by Nathan Pike, one was a male, which conformed to *H. senilis*. And some damaged part-specimens, also from Cambridge, contained four loose male abdomens, all of which showed *H. senilis*-shaped post-anal lamellae.

Finally, two further males of *Heringia* emerged in January 2001 from *Pemphigus* galls collected from another south-London site, Peckham Rye Park, during October 2000. One was distinctly *H. senilis*, the other worked to *H. heringi*, except that the third antennal segment was longer than usual.

Specimens, a male and an associated female, have been deposited in the collections of the Natural History Museum (London), National Museums & Galleries of Wales (Cardiff) and British Entomological and Natural History Society (Dinton Pastures). Additional material will also be placed in the collections of the National Museums of Scotland (Edinburgh), from amongst specimens reared from larvae already donated.

Biology, life history and distribution

The larvae of *Heringia* were found inside the characteristic spiral leaf petiole galls caused by the common communal aphid *Pemphigus spyrothecae* (Figs 10 & 11).

Table. Summary of characters distinguishing *Heringia senilis* and *H. heringi* (males only), derived from Claussen *et al.* (1994).

	H. senilis	*H. heringi*
Antennal segment 3	Elongate, about twice as long as wide (Fig. 1).	Oval, at most about 1.5 times as long as wide (Fig. 2). (NB: in female it is twice as long as wide.)
Hind tibiae	White-haired on anterior and dorsal surfaces.	Black-haired on anterior and dorsal surfaces.
Top of thorax	White-haired on disc.	Dark-haired on disc.
Post-anal lamella	Evenly serrate with many small teeth (Fig. 3).	Distinctly toothed at corners, sometimes also at centre (Figs 4–7).
Surstyli	Shorter and broader, 3.1 times as long as wide, less sculpture.	Longer and narrower 3.2–3.6 times as long as wide, more sculpture.
Face	White haired.	Dark haired.
Frons	Shimmering dark blue.	Black.
Eyes	White-haired.	Black-haired.

Unlike many aphids it utilizes but a single host plant. The sexuparae (a parthenogenetic pre-sexual generation) leave the galls from early September onwards and aggregate in the cracks in the bark. Each sexupara gives birth to about two males and five females. Mating occurs immediately that the sexuals are mature (they go through four moults but do not feed) and each female lays a single egg. These eggs over-winter in the crevices of the tree after the leaves and their associated galls have fallen. The foundresses emerge to start new galls in the spring.

To the naked eye the larvae of *H. senilis* exactly resembled those of *H. heringi* described by Rotheray (1993), being small (about 5 mm) brown, flattened and covered with many tiny round papillae. A full description of larva and puparium is now underway (Rotheray, in preparation).

When the spiral galls are slightly untwisted, the fluffy aphids are revealed inside (Fig. 12), together with a blob of honeydew dusted with a waxy coating which prevents it clogging the gall's occupants. The galls first appear in spring (Fig. 10), but are at their most developed in August and September (Fig. 11), and it was at this time that the *Heringia* larvae and other occupants were found. Early in October the leaves start to fall and the galls turn red and yellow, making them especially obvious on heavily galled trees. Fallen galls sometimes contained aphids, but no *Heringia* larva or other insects were found in them.

Under artificial conditions the *Heringia* larvae left the galls and remained dormant, resting on the sides of the glass tubes through the winter. In an unheated room in the winter of 1999/2000 they finally pupated in April and adult flies emerged in May. However, in a heated room in the winter of 2000/2001 they pupated in early January and emerged at the end of the month.

Pemphigus is also unusual in that it has a primitive caste system, with some of the first-instar nymphs taking on the role of soldier. These soldiers are able to attack and repel various aphid-predator invaders, but may ignore, or are incapable of detecting, *Heringia* larvae (Pike, in preparation). The presence of large numbers of *Heringia*

Figures 10 & 11. Spiral galls caused by the communal aphid *Pemphigus spyrothecae* in the leaf petioles of Lombardy poplar, Forster Memorial Park, 6.v.1999 (10) and 10.viii.1999 (11).

Figure 12. Partly opened gall of *Pemphigus spyrothecae*, revealing the aphids within, Forster Memorial Park, 10.viii.1999.

larvae inside the galls surely testifies to the flies having evolved some strategy for avoiding this attack.

On the Continent, *Heringia senilis* is reported to be widespread in central and southern Europe, the Caucasus, Transcaucasia, Kazakhstan and Uzbekistan. Likewise, *H. heringi* is noted across the whole of Europe, from Scandinavia to Spain, east into Turkey, Siberia and Mongolia (Claussen *et al.*, 1994). No clear distinction is made between any habitat preferences. Given that both species were reared from south-London *Pemphigus* galls, it seems likely that both species have similar life histories, and that *H. senilis* may well be an overlooked but widespread species in Britain.

With experience of only limited British localities it is difficult to draw any conclusions about *Heringia* habitat preferences in Britain, except to note that both Catford and Peckham sites were formerly old parkland, with many very old trees (though not necessarily the Lombardy poplars) which pre-date the present metropolitan layouts. Peckham Rye was formerly part parkland and part farmland; it is now predominantly utility grass and playing fields with relatively little invertebrate interest. Forster Memorial Park, on the other hand, is reckoned to be a double assart (a medieval clearing within a wood for agricultural purposes), with remnants of possibly ancient woodland remaining as wooded edging strips. Other old woodland insects found there included the nationally scarce hoverfly (Syrphidae) *Didea fasciata* Macquart, the nationally scarce stilt-legged fly (Megamerinidae) *Megamerina dolium* (Fab.), the nationally scarce fungus beetle (Melandryidae) *Abdera quadrifasciata* (Curt.), the stag beetle (Lucanidae) *Lucanus cervus* (L.); the

nationally scarce weevil (Curculionidae) *Cossonus linearis* (Fab.), and the nationally scarce timber-nesting ant (Formicidae) *Lasius brunneus* (Latr.).

Apart from *Heringia senilis*, other inhabitants of the *Pemphigus* galls included: *Heringia heringi*, male, emerged 27–29.i.2001, Peckham Rye: *Meliscaeva auricollis* (Meigen), male, emerged xi.2000, Peckham Rye; *Wesmaelius subnebulosus* Stephens (Neuroptera: Hemerobiidae), female, emerged xi.2000, Peckham Rye; *Anthocoris minki* Dohrn (Hemiptera: Anthocoridae), many specimens in the galls, 30.ix.1999, Forster Memorial Park; a diplazontine hoverfly parasitoid (Hymenoptera: Ichneumonidae), emerged 1–5.iii.2001, Peckham Rye.

Conclusion

The exact status of *Heringia senilis* remains in doubt, but it is clear that it and *Heringia heringi* found an intriguing niche when they invaded the self-contained and secret world of the *Pemphigus* gall. The aphid and its galls are common and widespread, and obviously worthy of closer attention from dipterists and other naturalists.

Acknowledgements

The initial survey of Forster Memorial Park was originally commissioned by John Archer, of the London Ecology Unit (now the Greater London Authority), on behalf of the London Borough of Lewisham. Malcolm Smart of Wolverhampton kindly translated relevant parts of the keys by van der Goot (1981) and Verlinden (1991), and Felicia Ure translated parts of the paper by Claussen *et al.* (1994). Nigel Wyatt of London's Natural History Museum made available the museum's *Heringia* specimens and concurred with my interpretation of the sometimes difficult genitalia characters. Nathan Pike of the University Museum of Zoology, Cambridge, supplied some of his leftover specimens of *Heringia* and provided information on the biology of *Pemphigus* aphids. Graham Rotheray of the National Museums of Scotland in Edinburgh enthusiastically took on the task of studying some of the *Heringia* larvae. Claus Claussen of Flensburg, Germany, granted permission to reproduce some of the line figures from his paper. Colin Plant identified the lacewing that emerged from one of the galls. Additional information, advice and support were also given by Alan Stubbs and Peter Chandler. My thanks go to all these people for their help in preparing this paper.

Incidentally, the discovery of *Heringia senilis* was a direct result of a feature on *Pemphigus* galls in the August 2000 issue, of *BBC Wildlife*. Asked to provide some editorial background information about the aphids, I agreed to photograph them in their galls. In the event the photos were not used, but during the search in Catford I first uncovered the *Heringia* larvae.

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An appeal for material of British Psychidae

As part of my studies into the effects of atmospheric pollution on lichenophagous bagworm moths (Lepidoptera: Psychidae) I am conducting an analysis of the genetics (DNA) of the British bagworms. In order to complete this I wish to include the following species:

Dahlica lichenella (L.)
Bacotia sepium (Speyer)
Proutia betulina (Zeller)
Psyche crassiorella Bruand
Whittleia retiella (Newman)
Acanthopsyche atra (L.)
Pachythelia villosella (Ochsen.)
Sterropterix fusca (Haw.)

I would be very grateful if readers could supply me with fresh material reared or collected during the last 3 or 4 years. A small fragment such as a leg or a piece of pupal exuvia is all that is required, provided that identification of the species concerned is sound. Alternatively, advice concerning known habitats and timings when larvae may be obtained would be most welcome. I can supply readers with postage tubes for dried material and will refund postage and packing. Thanking you in anticipation.—IAN SIMS, 2 The Delph, Lower Earley, Reading, Berkshire RG6 3AN. Email: sims@wrcplc.co.uk